

Acupuncture in Asthmatic Children: A Prospective, Randomized, Controlled Clinical Trial of Efficacy

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ABSTRACT

Background • The incidence of asthma and asthmatic bronchitis (hereafter asthma) in Danish preschool children is estimated to be 10%-20%. Few well-controlled studies have been published on acupuncture and asthma, and no researchers have focused on asthma in preschool children.

Objective • The study's primary objective was to investigate the efficacy of acupuncture for treating asthma in children aged 6 mo–6 y.

Design • This study was a prospective, randomized, controlled clinical trial.

Setting • The study was conducted in two acupuncture clinics in Denmark.

Participants • The research team randomly selected preschool children with medically diagnosed asthma and assigned them 1:1 to an intervention or control group.

Intervention • The intervention group received 10 acupuncture treatments over 3 mo. The control group received no placebo treatment.

Primary Outcome Measures • Efficacy was evaluated using asthma diaries. A Wilcoxon rank sum test was used

for the analyses of longitudinal intragroup changes and paired differences between groups. Using a two-sided, 5% significance level and a power of 90%, a sample size of 100 patients/group was necessary.

Results • The research team randomly selected 122 children, with 52 children (26 intervention, 26 controls) being available for evaluation at 12 mo. Symptom scores and medication use were not different between the groups at 8 mo after completion of acupuncture. Significant reductions were observed in subjective asthma symptoms and in use of inhaled steroids (IHS) and β_2 agonists in both groups at 3 mo. Compared with the control group, the reduction in asthma symptoms ($P = .0376$) and use of IHS ($P = .0005$) was significantly larger in the intervention group.

Conclusion • Although the effect was not sustained beyond the treatment period, the study demonstrated that acupuncture had an effect on asthma in preschool children for the duration of the treatment course as assessed by subjective parameters and use of medication. (*Altern Ther Health Med.* 2013;19(4):13-19.)

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The incidence of asthma and asthmatic bronchitis (hereafter asthma) in Danish preschool children is estimated to be 10% to 20%.^{1,2} The morbidity is considerable due to frequent upper respiratory infections that often trigger asthma symptoms in this age group.³ Breakthrough symptoms occur, despite relevant anti-asthmatic treatment in the form of inhaled steroids (IHS) and β_2 agonists. Many parents of asthmatic children consequently seek alternative treatment options, such as acupuncture.^{4,5}

Acupuncture in asthma has mostly been investigated in adults.⁶ The studies were rarely well-controlled, used a lim-

Table 1. Treatment Schedule^a

Run-in	Acupuncture (mandatory)	Acupuncture (optional)	Follow-up
2 wk of filling in questionnaire A	10 courses of acupuncture + acupressure during a period of 3 mo	• 3 courses of acupuncture + acupressure during a period of 1 mo. Observation for 8 mo.	Completion of questionnaire C
A		B	C
Baseline minus 2-4 wk	Baseline – 3 mo	Completion of questionnaire B 2 wk after the treatment period	12 mo postcompletion of questionnaire A

^aGraph of study period and data collection. Questionnaires and asthma diaries were submitted at points A, B, and C. Ten courses of acupuncture and acupressure were given from baseline to 3 months. During the subsequent months, three additional courses of acupuncture and acupressure were offered as an optional treatment. Questionnaires A and C were completed at the same time of the year with the time interval between being 12 months.

ited number of participants, and lacked consistency in methodology,⁷ and only some of the studies found evidence that suggested a beneficial effect for acupuncture in treating asthma in adults.⁸ A few controlled studies of acupuncture treatment of older asthmatic children have been published, with conflicting results.^{9,10,11,12} The safety profile of acupuncture, however, has been confirmed to be very favorable,¹² and newer noninvasive laser methods appear to be particularly appealing for the use in children. Still, the laser acupuncture method has so far not demonstrated a clear effect in the treatment of asthma in children.¹³

No data are currently available for preschool children. Empirically, the authors have found traditional Chinese acupuncture to be useful in the treatment of asthma. Chinese acupuncture is based on a holistic philosophy, where acupuncture as traditional Chinese medicine is combined with acupressure. The objective of this project is to study the efficacy of acupuncture in treating asthmatic children, aged 6 months to 6 years.

MATERIAL AND METHODS

Participants

Participants were referred from general practitioners or through parents who made inquiries following advertising about the study in the local media. Groups of 50 eligible children were collected before randomization took place in a blinded manner.

Inclusion criteria required participants to have asthma symptoms for at least 4 of 14 days during the inclusion period. Exclusion criteria comprised (1) the existence of other serious chronic disease, (2) the use of systemic steroids during the inclusion period, and (3) an incorrect completion of or failure to submit an asthma diary as the study required.

The project was approved by the Ethics Committee in Aarhus (No. 20020158). Participants were informed verbally and in writing about the project, and parents signed informed consent forms prior to inclusion of their children in the study.

Methods

This study was a prospective, randomized, 1:1 parallel-group, open study running for 12 months and including as participants children aged 6 months to 6 years with medically diagnosed asthma. The study was carried out by two experienced health care professionals (HCPs) trained in giving acupuncture at clinics in Grenaa and Tørring near Vejle in Denmark between 2002 and 2007. The primary endpoint was an evaluation of the differences between groups at 12 months regarding changes in asthma symptoms and medication.

Three times during the study, parents registered symptoms, use of medication, and the child's general condition in a daily diary. Symptoms like coughing, wheezing, and extensive production of mucus were rated on a scale from 0 to 3. Nightly symptoms and exercise-induced exacerbations were registered. The general condition of the child was evaluated based on hyperactivity, mood, exhaustion, constipation, eczema, and allergy symptoms, also on a scale from 0 to 3.

Parents completed asthma diaries and questionnaires over a 2-week period at (1) point A prior to treatment start (baseline minus 2-4 wk) (2) point B after 3 months of intensive acupuncture, and (3) point C after a subsequent observation period (12 mo after questionnaire A). The research team gave the questionnaires to the parents of the intervention group and mailed them to the parents in the control group. Questionnaire A enclosed demographic information. After 3 months postbaseline (ie, between points B and C), parents could request three additional acupuncture treatments. For the remaining period until 11 months postbaseline, children were observed. The initial questionnaire A and final questionnaire C were completed at the same time of the year with a time span of 12 months in between to avoid bias from changing seasons and weather conditions. Questionnaire C was identical to B, except that questionnaire C included one additional question about exposure to secondhand smoke. All completed questionnaires and diaries were submitted directly for statistical analysis. The HCPs at no time had

Table 2. Demographic Variables at Inclusion

Treatment	n	Age (y)	Disposition		β_2 agonists number of puffs/24 h	IH-steroids (average $\mu\text{g}/\text{d}$)
		Mean (SD)	Asthma	Allergy		Mean (SD)
Acupuncture	64	2.8 (1.6)	31	34	2.2 (2.1)	537 (260)
Control	58	2.2 (1.1)	28	39	2.8 (4.2)	476 (271)

Abbreviations: IH = inhaled; SD = standard deviation.

access to the symptom scores.

Both groups received written dietary guidelines on avoidance of cow's milk products. Following the dietary advice was voluntary. Disposition to asthma and allergy, use of medication, development of the child, consumption of products using cow's milk, and exposure to daily second-hand smoke were not feasible.

Intervention

The study was unblinded. The intervention group received 10 acupuncture treatments during the first 3 months. Table 1 displays the treatment course. Each session took 1.5 hours ($2 \times .5$ h with a break of .5 h in between) in which an acupuncture needle was placed between the first and second toe on both feet (acupuncture point Liver 2). Sterile disposable needles were used.

LIV2, or acupuncture point Liver 2, is empirically acknowledged to have cooling and sedating effect on liver fire. LIV2 is not a traditional asthma point, but the cooling effect is likely to occur in children less than 6 years of age. The choice of acupuncture point LIV2 was based on empirical knowledge and clinical experience, with the HCPs performing the acupuncture in the study. As a supplement, massage and pressure were provided at specific acupuncture points. The points that were used for massage were also decided upon by the project team based on empirical knowledge. The points widely covered asthma and comprised the following: LU7, REN17, REN22, LI4, PC6, SP6, SP10, ST36, ST40, K3, K7, DU14, DU20, and *Dingchuan* (EX17). The clinical experience of the authors indicates that, in some cases, transient coughing due to loosening of mucus can occur during the first treatments.

Parents of children in the study were instructed to do acupressure between visits to the clinic. Parents of children in the study were asked to perform the massage themselves as it may have an effect for home care. However, the most prominent effect is expected to occur when acupuncture at LIV2 is combined with acupressure. The intervals between visits increased from 3 days between the first two visits to 14 days between the last two visits. Placebo acupuncture was omitted for the control group because a potential positive effect could not be ruled out.¹² Changes to asthma medication were managed by the child's general practitioner.

Statistical Analysis

The primary endpoint was an evaluation of changes in

asthma symptoms and use of medication based on analyses of the asthma diaries at 12 months to determine the differences between the intervention and control groups. Secondary efficacy parameters were differences in symptoms and medication changes between groups at 3 months and changes over time within groups. A Wilcoxon rank sum test was used for the analyses of longitudinal intragroup changes and paired differences between groups. Questionnaires A, B, and C were analyzed using likelihood ratio χ^2 . For $n < 5$, Fischer's exact test was used. To detect a difference between groups with a two-sided, 5% significance level and a power of 90%, a sample size of 100 patients/group was necessary.

RESULTS

Table 2 displays patients' demographics at inclusion. The research team randomly selected 164 participants. Figure 1 displays the study's flow chart. In the intervention and control group, respectively; 38 children in the intervention group and 32 children in the control group were lost to follow-up due to missing diaries after 12 months.

Development and General Health

No significant differences existed between groups in the changes in general development of the children. In the intervention group, the changes in general health were positive in 27, neutral in 5, and negative in 2 children. In the control group, the general health was positive in 15, neutral in 10, and negative in 1 child.

Symptoms

The children's general symptoms decreased significantly in both groups from points A to B ($P < .001$) and from points A to C ($P < .001$). A significant reduction in symptoms between groups occurred from points A to B (3 mo; $P = .0376$). See Figure 2. The difference in symptoms between groups, however, was not significant from points A to C at the end of the observation period (12 mo; $P = .148$).

Medication

At the time of recruitment, 60 out of 64 children in the treatment group (mean [SD], 537 μg [260]) used inhaled steroids (IHS) as compared with 48 out of 58 children in the control group, (477 μg [271]), indicating that no significant difference existed between the groups with regular use of inhaled steroids. Most of the children received IHS (budesonide and fluticasone), including three cases as combination

Figure 1. Participant Flow

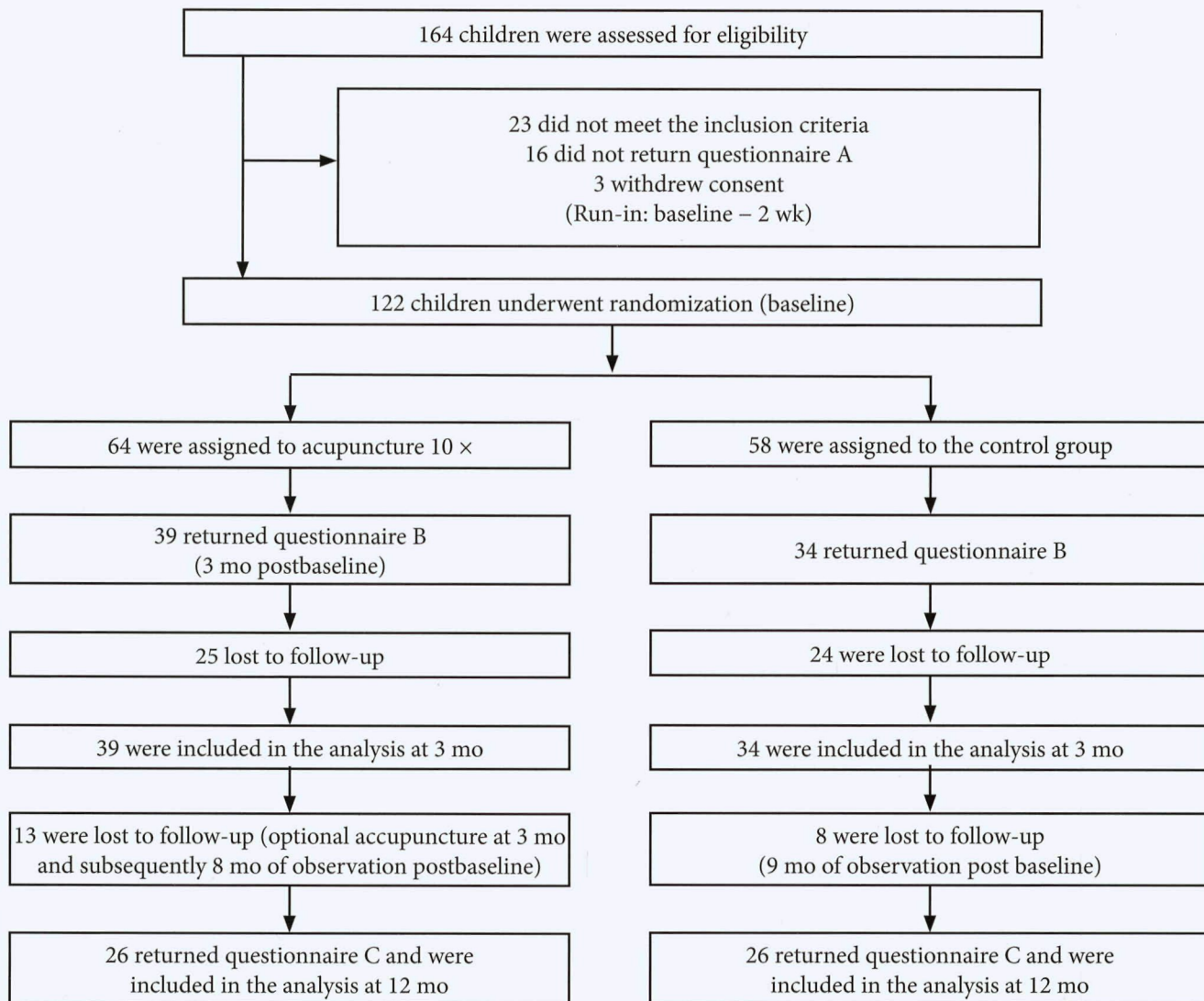
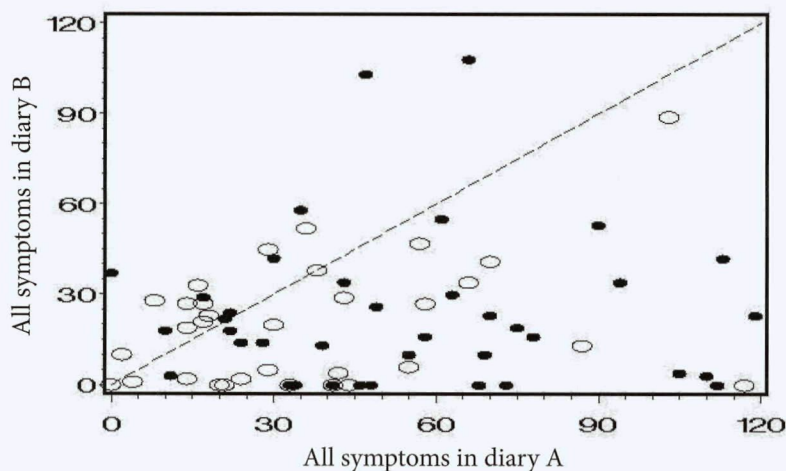
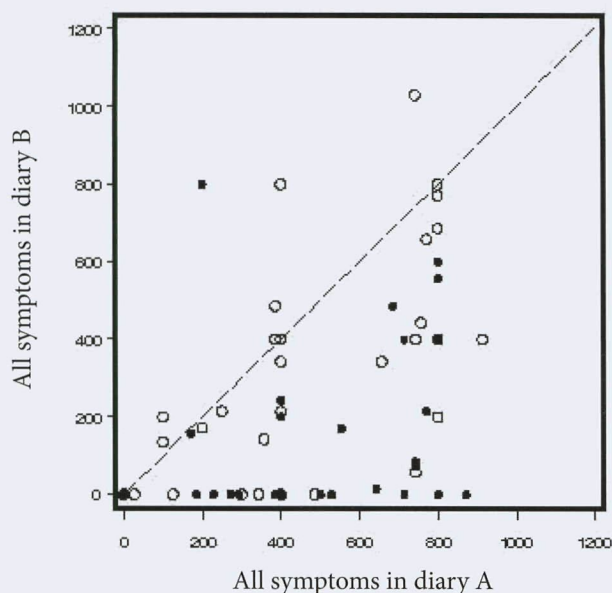


Figure 2. Reduction of Symptoms^a



^aThis figure is a plot graph for patients' total asthma symptoms in the intervention group (•) and the control group (o), respectively. Each point (•) indicates the individual child's asthma symptoms in the 14 days before point A compared with symptoms after 10 acupuncture treatments (point B).

Figure 3. Reduction of Medication^a



^aAverage daily use of steroids (μg) in the intervention group ($\bullet$) and the control group ($\circ$), respectively, before point A and after 3 months (point B) during which the intervention group had received acupuncture treatment.

Table 3. Change of Medication Between Baseline and 3 Months^a

		Baseline		3 Mo	
		n	Mean μg (SD)	n	Mean μg (SD)
IHS	Control	60/64	537 (260)	14/39	126 (209)
	Active	48/58	477 (271)	26/34	342 (287)
		Mean puffs (SD)		Mean puffs (SD)	
β_2 Agonist	Control	2.2 (2.1)		0.7 (1.1)	
	Active	2.8 (4.2)		0.9 (1.3)	

^aA statistically significant reduction in the use of inhaled steroids (IHS) was observed in both groups ($P < .0001$); however, the reduction was significantly larger in the active group ($P = .0005$). As for β_2 agonists, no significant differences existed between the groups. The use of β_2 agonists, however, dropped significantly within groups after 3 months ($P < .001$).

therapy budesonide + formoterol ($n = 2$) and fluticasone + salmeterol ($n = 1$). Inhaled salbutamol and terbutaline were used as rescue medications. At 12 months, use of IHS was significantly reduced, but no difference existed between the two groups. At 3 months, 14 out of 39 children in the intervention group used IHS compared with 26 out of 34 in the control group ($P < .001$). The daily average use of steroids in the intervention group and the control groups dropped to 126 (209) μg and 342 (287) μg , respectively. Figure 3 shows the changes in the use of steroids for each child from points A to B. A statistically significant reduction in the use of steroids was observed in both groups ($P < .0001$); however, the reduction was significantly larger in the intervention group ($P = .0005$). No significant changes occurred from points B to C.

No significant differences in the use of β_2 agonists

existed between groups at points A, B, or C. The use of β_2 agonists dropped significantly in both groups from point A to point B ($P < .001$) and from A to C ($P < .001$) but not from B to C. In the treatment group and the control group, respectively, the average number (mean [SD]) of daily puffs dropped from 2.2 (2.1) and 2.8 (4.2) to 0.7 (1.1) and 0.9 (1.3) after the period during which the intervention group received 10 acupuncture treatments and to 0.4 (1.0) and 0.5 (1.0) 8 months later. No children were treated with leukotriene antagonists.

Table 3 displays the mean medication use in the intervention and control groups at baseline and after 3 months.

Other Factors

Consumption of Cow's Milk Products. At recruitment, 61 (95%) children and 52 (90%) children in the intervention

and control group, respectively, consumed cow's milk products daily. After 3 months, the numbers were 28 (72%) of the children in the intervention group and 28 (83%) of the children in the control group ($P = .036$). At 12 months, all of the children in the intervention group and 23 out of 24 children in the control group consumed cow's milk products.

Secondhand Smoke. One child in the intervention group and one child in the control group were exposed to secondhand smoke as assessed at baseline and 12 months.

DISCUSSION

Published in English, this study is the first randomized, controlled trial on the efficacy of acupuncture as a treatment for asthma in preschool children, demonstrating a significant reduction in asthma symptoms and use of IHS in the intervention group compared with the control group at 3 months. Recently published results from an observational cohort study¹⁴ confirm the positive effects of acupuncture.

In the current prospective, randomized, and controlled study, a reduction in the use of β_2 agonists was also found in addition to an improvement in the participants' general symptoms; however, the changes were not significantly different from the changes observed in the control group. At 12 months, it was no longer possible to demonstrate differences between the two groups, in terms of asthma symptoms, general symptoms, or use of medication.

Over 12 months, significant reductions in asthma symptoms, general symptoms, and use of medication were observed in both groups. The changes in the control group may be interpreted as a spontaneous improvement of the children's asthma. Generally, a high spontaneous remission rate occurs in infants with asthma or asthmatic bronchitis.

Placebo acupuncture was omitted as it can result in secretion of endorphins, vasoactive substances, and anti-inflammatory cytokines that potentially could have an effect on asthma.¹⁵ In contrast to the intervention group, the control group was not in regular contact with the HCPs. The subjective assessment of efficacy was also a limitation to the study; however, this method was the only feasible way due to the age of the study's participants.

The most distinctive change in the acupuncture group was a significant reduction in the use of IHS. At 3 months, the average use of steroids was halved, and 64% of the children in the intervention group were no longer treated with IHS compared with 24% in the control group ($P < .001$). It is likely that parents in the acupuncture group felt encouraged in discontinuing IHS, as the child received other treatment. If the child's asthma had not improved simultaneously with the IHS tapering, however, worsening of asthma symptoms and increased use of β_2 agonists would have been expected. On the contrary, the children had significant reductions in asthma symptoms and use of β_2 agonists. Hence, this effect is attributed to a real improvement in the children's asthma due to the acupuncture treatment. The effect was not present beyond the end of the treatment period. After 12 months, no significant differences in the efficacy parameters existed

between the intervention group and the control group. Researchers may speculate as to whether ongoing treatment with acupuncture would sustain the differences between groups. The data concerning consumption of cow's milk products were inconsistently collected as it was voluntary for the parents to follow the advice given. Hence, the data were inconclusive.

Of the 122 randomized children, 73 children were still participating after 3 months, and 52 children completed 12 months. The main reason for dropping data for children was failure of the parents to return the diaries. No difference in the severity of asthma existed at baseline among the cases that were lost to follow-up. The drop-out rate was identical in the intervention group and the control group. Reasons for drop outs were not given during the study, as the diaries and questionnaires were not returned, and the research team speculates that follow-up visits or phone calls to the parents between 3 and 8 months could have improved compliance.

Published data on acupuncture in older children are scarce and conflicting.⁹⁻¹⁴ Fung et al found that acupuncture given 20 minutes prior to exercise could reduce the degree of exercise-induced asthma (EIA).⁹ Laser acupuncture seems particularly useful in children due to the favorable safety profile and noninvasive method; yet again the data are conflicting. Gruber et al¹⁰ studied the efficacy of laser acupuncture in 44 older children with EIA before and after provocation with cold air in a double-blind, crossover design. They did not find any protective effect against EIA in using correct acupuncture versus sham acupuncture. Stockert et al later demonstrated an effect of laser acupuncture on bronchial hyperactivity in a small placebo-controlled, double-blind pilot project¹¹; however a review on laser acupuncture concluded that the available data was inconclusive on the effects of this noninvasive method.¹³

Data on acupuncture for treatment of asthma in adults largely comprise uncontrolled and/or relatively small studies. Martin et al⁶ reviewed 200 publications but found only 11 controlled studies suitable for review, with a total of 202 participants. Selection heterogeneity remained an issue, and the conclusion was not in favor of acupuncture. In a Cochrane review by McCarney et al in 2004,⁷ the reviewers concluded that even though some studies had shown a positive effect for acupuncture on subjective asthma symptoms and use of medication, acupuncture was not recommended as a general treatment to offer asthmatics. Christensen et al⁸ demonstrated a significant effect of acupuncture on peak flow (PEF) symptoms and use of β_2 compared to placebo in adults after 2 weeks of treatment.

CONCLUSION

The results presented herein imply that acupuncture has a positive effect on asthma in young children for as long as treatment continues and suggest that acupuncture may be considered an adjuvant to conventional asthma therapy (Figure 4).

Figure 4. Acupuncture Performed in a Child With Asthma



ACKNOWLEDGEMENTS

The authors thank Jørn M. Henriksen, MD, in the Pediatric Department at Skejby Hospital for guidance prior to the study's initiation and for supervision while writing the manuscript. Likewise, the authors are grateful for project assistance from Hanne Damm Corell, a registered alternative therapist in Vejle, Denmark. The authors also thank Jørgen Granfeldt, a statistician at Aarhus University, for statistical work-up, and journalists Lone Bolter Rubin Thomsen and Charlotte Strøm, MD, for medical writing assistance.

AUTHOR DISCLOSURE STATEMENT

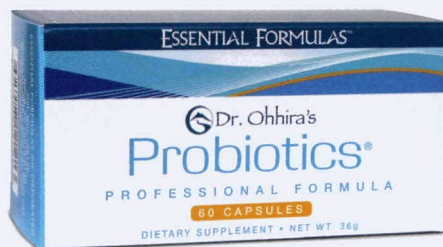
The study received grants from ViFAB (Videns-og Forskningscenter for Alternativ Behandling), IMK Almene Fond, and Aase og Ejner Danielsens Fond, trial registration: EudraCT No. 2012-004095-19.

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